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THE ERRORS

OF

REFRACTION,

BY

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OF WHEELING, W. VA.

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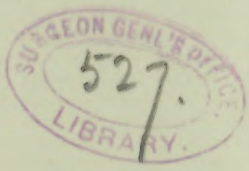

THE ERRORS OF REFRACTION,

BEFORE THE

STATE MEDICAL SOCIETY

OF WEST VIRGINIA.

BY

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THE ERRORS OF REFRACTION.

BY JOHN L. DICKEY, M.D., WHEELING.

The nineteenth century will be one marked in the history of medicine by the birth and growth of important specialties. Nearly all of them owe their origin to mere accidents, which fortunately occurred at the hands and under the observation of men who were able to turn to account what might have escaped minds of feebler grasp.

The first stethoscope was a roll of paper containing notes of cases in the hands of Lænnec as he walked the wards of a hospital. By applying one end of the roll to the chest of a patient and the other to his own ear the observant physician found he could hear the obscure sounds of the hidden thoracic organs much more distinctly. This was the trivial origin of an instrument that has contributed so much to the mass of accumulating knowledge of heart and lung diseases, and has thus been so important a factor in the formation of that important branch of medicine, physical diagnosis.

Marion Sims, the Father of Gynaecology, tells us in the Story of his Life that he had neither taste nor talent for studying diseases of women, in fact that nothing was more distasteful to him than the examination of the female pelvic organs. An acute retro-version of the uterus fell under the care of the young surgeon. The genu-pectoral position and hooking up the posterior wall of the vagina with his thumb brought immediate relief, and Sims' speculum was born. The cure of vesico-vaginal fistula was accomplished after many weary months of disappointing failures, and the result is a specialty that has proved a boon to thousands of suffering women.

In 1851, only thirty-four years ago, Helmholz constructed a clumsy ophthalmoscope and saw the background of an eye. The optic disc, like a bright, full moon, with the winding streams of blood traversing its surface, met his delighted gaze,—and opthalmology became a science. No longer was amaurosis to be called "a disease in which neither the patient nor the doctor could see anything," but with the new instrument diseases of the eye that had been obscure could now be recognized and treated. The ophthalmoscope has grown into one of the most powerful aids to diagnosis. The first symptoms of many diseases of the nervous system, the kidneys, and the blood, are often intraocular and can be seen only

by the ophthalmoscope. For much of this knowledge we are indebted to the admirable work of Gowers.

The labors of Airy, Young, Sanson, Purkinje, and others, extending through the last hundred years and culminating in the masterly treatise of Donders, have given us the science of Refraction. A large and important part of the modern oculist's work consists in correcting the refractive errors and prescribing the proper glasses. Few eyes are emmetropic. A noted German oculist irreverently remarked that he would send back to his instrument maker the instrument that had been so imperfectly constructed as the average human eye. The natural defects have been increased by our advanced system of education, our poorly lighted school rooms, and the rigid requirements of a busy age These errors of refraction are three, hypermetropia, myopia, and astigmatism. The first, due to the flatness of the posterior segment of the eye-ball, from which it is sometimes called axial hypermetropia, is always congenital. A large proportion of children, 72 per cent., are hypermetropic at birth. In high degrees of this defect the eye-ball is too small in all directions. This is often caused by an arrest of development, as in children very small at birth, or in those that have not gone to full term. Such cases can always be recognized at a glance by the flat forehead, the dish face, the low nose, and the small, lack-lustre eyes. They are brought to you because they are very "near sighted," cannot see the figures on the blackboard at school, and hold the book very close to the face. Instead of being near sighted they are extremely far sighted, and objects are held close in order to enlarge the badly defined images. Such eyes are generally more or less amblyopic, but after wearing proper glasses constantly the vision gradually improves and after some time may reach the normal power. In correcting the eyes of children and young adults I always use a mydriatic and prefer duboisine (grs. ii—dr. i) because it paralyzes the accommodation more promptly than atropine, and because its effects pass away more rapidly. In three days, generally, the accommodative power is fully restored, though the pupil may remain dilated several days longer. In hypermetropia of more than two dioptrics it is very seldom that the full correction, as found under a mydriatic, can be ordered. In some cases I have found it necessary to order glasses of only half the strength, which can gradually be increased after wearing constantly for some time.

The symptoms of hypermetropia depend, of course, on the degree, the age, the occupation, and the state of health. The most common ones are, mistiness of sight; blurring and running together of letters and lines; drowsiness after reading a short time; burning, smarting, watering or aching of the eyes; and a chronic congestion of the conjunctiva, which may lead on to granulated lids. Nearly all cases of convergent strabismus are caused by hypermetropia, although it is a fruitless task to attempt to convince a fond mother that her child did not become cross-eyed from spasms, from whooping cough, from a blow on the head, from looking intently at the nursing bottle, or from any one of a thousand other causes. In fact any one of these may have been the immediate

cause, but the congenital defect was the primary one, in ninety-nine out of a hundred cases. The *rationale* is plain. Convergence and accommodation go together, and the effort being greater in a hypermetropic eye, the internal recti muscles become over developed. This strain being removed, then, by the proper convex glasses, a periodic squint is cured; while a constant squint requires an operation and the glasses too, otherwise the same cause will again produce the same effect, or else constant disagreeable symptoms. The surgeons of not very long ago who went from town to town straightening eyes, could have gone over the same ground in three or four years and found many of the same eyes to straighten again.

Blepharospasm is often caused by hypermetropia, especially in children with a chronic tendency. This fact was impressed on my mind by seeing a case of a young woman of eighteen whose lids would be closed for half a minute by a violent spasm of the orbicularis muscle; she was entirely cured in a couple of weeks by wearing constantly the full correction of only one and a half dioptrics.

Glaucoma is much more common in hypermetropic than in myopic or emmetropic eyes. The habitual use of the proper glasses from an early age may aid indirectly in preventing this serious trouble.

Myopia is that condition of the eye in which the image falls in front of the normal focal point on the retina. Caused, as it generally is, by the antero-posterior diameter being too long, it is sometimes called axial myopia. The small pointed eye, and the habit of partly closing the lids, which is done to lessen the indistinctness of distant objects and on account of the intolerance of bright light, give a peculiar significance to the meaning of the word myopia,—mouse-eyed. The myope can often be recognized by the small, half-shut eyes and frowning expression, the sharp features, the pointed nose, and general contour of the head, of which the eyes partake. Myopia is seldom congenital, but the tendency towards it, especially in marked cases, is frequently hereditary. Pointed features and myopic eyes can often be distinctly traced through several generations. The defect usually appears between the ages of seven and fifteen and progresses till twenty-five. Habitual use of the eyes in close work aids strongly in producing it, and it has been justly remarked that the whole German nation, with their thorough and protracted process of education, and their national habit of study, has become myopic. The advice of an oculist is most commonly sought by myopes on account of eye-ache, headache, watering of the eyes, photophobia, dimness of vision, or bad distant sight, the patient having made enemies of his friends by repeatedly passing without recognizing them. A high degree of myopia, allowed to go uncorrected, predisposes to detachment of the retina, to cataract, to a fluid condition of the vitreous humor, with opacities, and to choroidal hemorrhages. Floating specks (muscæ volitantes) are especially common and troublesome in myopia. As convergent strabismus is nearly always caused by hypermetropia, so divergent strabismus (wall-eye) is nearly always

caused by myopia. The accommodation and convergence are relaxed in order to bring more readily the image on the yellow spot of the retina, and thus the internal recti vessels become weakened.

The treatment of myopia is prophylactic and remedial. The former consists in so regulating the light, books and desks, that the temptation to stoop is removed. The light should come from over the left shoulder, for as we write and read from left to right the shadow of the pen is thus thrown away from the letters, and the best light falls on the catch words. The remedial treatment consists in wearing concave glasses that have been carefully found under a mydriatic. If the strength is not over six or eight dioptrics they should be worn constantly, otherwise weaker glasses are required for close work. Among an oculist's most grateful patients are the myopes for whom he has ordered the correcting glasses. As they frequently remark, they live in another world and realize what imperfect vision they have heretofore had.

Astigmatism is the third of the errors of refraction. Hypermetropia and myopia depend mostly on the form of the globe of the eye, astigmatism depends mostly on the curve of the cornea. If a certain meridian of the cornea is too flat or too full the rays entering at that meridian fall behind or in front of the retina and are blurred, do not come to a point, and hence the word astigmatism. Myopic astigmatism is sometimes caused from the horizontal meridian of the cornea being bulged out by the pressure of the lids swollen and heavy from the effects of a chronic catarrhal condition. Astigmatism is the most annoying of the refractive defects; certain lines have blurred margins; everything looks wrong; the visual effort is on a constant strain; numberless pairs of glasses have been tried, and have for a time seemed all right, but soon the same old troubles have returned. The defect is to be suspected in all cases of ametropia where spherical lenses do not raise the vision to normal, no other cause being discerned. As the hypermetrope can be recognized by the flat face, and the myope by the pointed features, so the astigmatic patient is known by a lack of symmetry in the head and face, and by the frowning and squinting caused by the vain endeavors to shut out the blurring rays. After finding the direction of the defective meridian in one eye that of the other can almost always be foretold. If the cylinder glass is at 90° in one eye it is invariably found to be at 90° in the other; 180° in one generally means 180° in the other; 45° in the right eye generally corresponds with 135° in the left; 160° in the right eye with 20° in the left, and so on. As a rule astigmatism of .5 of a dioptric can be allowed to go uncorrected, but if the eyes are much used for close work the correction of even so small a degree as half a dioptric gives great relief. I have frequently seen troublesome symptoms disappear with the use of a cylinder glass of this strength. Astigmatism, either simple or compound, is a frequent cause of the severe, nervous headaches which occasionally prostrate the unfortunate subjects. The pain in this class of cases is most severe at the back of the head and through the eyes. A common expression of such sufferers in describing their symptoms is that the eyes feel

as though they were being pushed out. The proper cylinder glasses that dispel these symptoms are invaluable to the wearer.

Any one of these defects, or astigmatism combined with hypermetropia or myopia, may exist in slight degrees and never cause any trouble; in fact the eye may be, for all practical purposes, perfect. Sailors, as a rule, have splendid vision, and many of them are found to have slightly hypermetropic eyes, probably their vocation has developed it. It is mostly among those who by their work are forced to overuse their eyes that the slighter errors of refraction call for correction, and give satisfactory results; as book-keepers, seamstresses, students, and barbers. In these occupations the accommodation, of course, is apt to be overstrained and weakened; when the error is corrected the accommodation regains its normal power and the symptoms disappear.

There is still another error of refraction, or more properly disorder of accommodation, which is not so much a defect in the eye as a natural result of advancing years; this is presbyopia, or long sight, because the patients push off the reading or sewing and jokingly declare that their arms are getting longer. It is the earliest mark of age and begins even in childhood, for at ten years the lens begin to harden slightly, and this gradual hardening, combined with the weakening of the delicate ciliary muscle, and the flattening of the cornea, culminates in presbyopia at the age of forty-three or thereabouts. In hypermetropes presbyopia sets in earlier, because less accommodation is available for near vision, and in myopes it comes later. Instead of wearing increasing convex glasses, patients with a high degree of myopia require decreasing concave glasses to correct their presbyopia, until at the age of seventy-five they may be better able to read and sew with no glasses at all. In emmetropic eyes distant vision remains almost as good as ever up to very old age, and the reading glasses gradually increase according to a regular scale, as follows:

Age.	*Dioptrics.*	*Inches.*
45	plus 1.	40
50	" 2.	20
55	" 3.	13
60	" 4.	10
65	" 4.50	8
70	" 5.50	6

Practically it is best to order the glass that enables rather small print to be easily read at twelve inches, allowing a range of eighteen inches. Such a glass should continue to do good service for five or six years

In the refractive part of the opthalmologist's work, as in all therapeutics, many cases occur in which theory fails, and in which good results can be obtained only by carefully consulting all the surroundings and drawing largely on good judgment and the mature results of observation. In this and all other arts "skill consists of a foundation of common sense and a superstructure of special education."